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The subject grant was a DURIP equipment grant. It was originally awarded on March 15, 1995 for a one year period. It was then given a one year extension (notification letter dated 13 June 1996) to 28 February 1997, and then a final three month extension (notification letter dated 28 May 1997) to 31 May 1997.

This DURIP equipment grant has provided us with the means to proceed in our development of MEMS devices for fluid dynamic and aerodynamic applications. It forms the essential base for our follow up work under AFOSR F49620-96-1-0482

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FINAL REPORT

LABORATORY FOR DEVELOPMENT, CALIBRATION AND UTILIZATION

OF MEMS DEVICES

AFOSR GRANT F49620-95-1-0212

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Case Western Reserve University
Cleveland, Ohio

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Department of Electrical Engineering and Applied Physics
Case Western Reserve University
Cleveland, Ohio

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The attached sheet headed "Budget" is from the DURIP proposal and is included here for reference. The dollar value of the award is $179,120 and the cost sharing commitment is for $30,610. As of the closing of the grant, $169, 857 of the dollar award has been spent and so $9263 is being returned to AFOSR. The cost sharing portion has been fully spent and since there is remaining work to be done, it will be overspent.

Of the MEMS Elements in the original budget, all of the items or their equivalents have been purchased. Regarding the Fluid Elements of the original budget, a new calibration channel was fabricated in-house at no direct cost to the grant and so is considered within the cost sharing. The three dof probe actuator system cost $10,844 rather than the amount budgeted and the materials for the new test section were purchased. The amount that is being returned to AFOSR is essentially the unspent amount for fabrication and laboratory

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setup that could not be committed by the date of the abrupt closure of the grant. That work will of course be completed and so should be considered as an additional part of our cost sharing.

The long term objective of our program is to develop the requisite technologies for integrating different sensors and actuators in desired combinations with electronics and telemetry on the same substrate. We are thankful for the DURIP award as the enabling element in our pursuit of a quality program.

Personnel

The work on this grant was carried out by the principal investigators and the staff of the CWRU Microfabrication Laboratory headed by Mr. Jeff Melzak,and by Mr. David Conger, principal technician in the Department of Mechanical & Aerospace Engineering.

Publications and Presentations

Mehregany, M., DeAnna, R.G. and Reshotko, E.: "Microelectromechanical Systems for Aerodynamics Applications," AIAA Paper 96-0421, Jan. 1996

Reshotko, E., Pan, T. Hyman, D. and Mehregany, M.: "Characterization of Microfabricated Shear Stress Sensors," Eighth Beer-Sheva International Seminar on MHD Flows and Turbulence, Jerusalem, Israel, Feb. 1996

Reshotko, E. and Mehregany, M.: "MEMS Applications in Aerodynamic Measurement Technology,: Invited paper presented at RTO/AGARD FDP Symposium on Advanced Aerodynamic Measurement Technology, Seattle, Sept. 1997

Acknowledgement/Disclaimer

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Budget

MEMS Elements	Requested Funds	Cost Sharing
Karl Suss PM 8 Analytical Probe Station plus accessories (Karl Suss, Joe McCarthy, 802-244-5181, ext. 240)	$ 49,560	
Two high voltage DC power supplies HP6209B	$ 3,300	
Two low voltage DC power supplies E3610A (Hewlett Packard, Paul Pecuch, 216-243-7300)	$ 600	
Long working distance objective microscope QM100 (Questar Corporation, John Ridge, 513-277-9650)	$ 16,810	
I-V/C-V measurement system (Keithley Instruments, Betsy Taylor, 216-729-2222)	$ 54,020	
Andeen-Hagerling, 2500A capacitance meter (Dr. Carl Hagerling, 216-349-0370)	$ 12,660	
Two Tektronix 2201 oscilloscopes (RS Electronics, Greg Atkins, 800-472-3231)	$ 4,750	
Two fume hoods (Lab Safety Supply, Marie Garber, 800-356-0783)		$20,610
Air table (Kinetic Systems, Charles Rogers, 617-522-8700)	$ 2,215	
Sundry electronic supplies		$ 5,000
Fluid Elements		
New wind tunnel test section for MEMS use, to be fabricated at CWRU - materials*	$ 3,000	
Flat plate test model for wind tunnel, to be fabricated at CWRU - materials*	$ 1,500	
Improved turbulence management section for 28"x28" wind tunnel - materials & labor		$ 5,000
Three dof probe actuators (Velmex, Inc., Dick Langkamp, 716-657-6151)	$ 5,500	
Calibration channels for MEMS sensors, to be fabricated at CWRU - materials*	$ 3,500	
*Labor costs for fabrication and laboratory setup:		
50% Senior Technician	$ 17,500	
Fringe benefits @ 24%	$ 4,200	
TOTAL	$179,120	$30,610